length of it is said to have been only about fourteen miles.

It is very probable, though not conclusively proved, that large meteoritic showers of stones, like those of Pultusk and L'Aigle, reach the terrestrial atmosphere as swarms of isolated bodies; still, we must have regard to the fact that a mass is much fractured during its passage through the air by reason of the enormous pressure and the violent change of temperature. In the case of the Butsura fall, for example, it was conclusively established that stones picked up some miles apart must originally have formed part of a stone disrupted during the atmospheric flight.

It is a question of a certain amount of interest as to whether there is any evidence of the actual fall of a shower of meteorites over a large extent of the earth's surface.

Such evidence has long been supposed to be furnished by the plentiful occurrence of meteorites in the Desert of Atacama, a term applied to that part of Western South America which lies between the towns of Copiapo and Cobija, about 330 miles distant from each other, and which extends inland as far as the Indian hamlet of Antofagasta, about 180 miles from the coast.

The generally received impression as to the occurrence of meteorites in this desert is well illustrated by the following statement of M. Darlu, of Valparaiso, read to the French Academy of Sciences in 1845:—

"For the last two years I have made observations of shooting-stars during the nights of November 11–November 15, without remarking a greater number than at other times. I was led to make these observations by the fact that in the Desert of Atacama, which begins at Copiapo, meteorites are met with at every step. I have heard, also, from one who is worthy of trust, that in the Argentine Republic, near Santiago del Estero, there is—so to say—a forest of enormous meteorites, the iron of which is employed by the inhabitants."

A study of the literature indicates that "the forest of enormous meteorites" near Santiago del Estero, understood by Darlu as significative of infinity of number, is really a free translation of a native statement "that there were several masses having the shape of huge trunks with deep roots," and that not more than four, or perhaps five, masses had really been seen in the Santiago locality at the time of Darlu's statement. There is a similar misunderstanding relative to the Atacama masses: it is clearly proved that, at a date long subsequent to 1845, the Desert was virtually untrodden and unexplored. In Darlu's time it was only crossed along definite tracks by Indians travelling between San Pedro de Atacama and Copiapo, and between the inland Antofagasta and the coast. In fact, it is established that the only Atacama meteorites then in circulation were all got from a single small area, three or four leagues in length, in the neighbourhood of Imilac, one of the few watering-places on the track between San Pedro and Copiapo.

Since that time the discovery of rich silver-mines in the centre of the Desert, and the working of the nitrate deposits, have led to vast changes; the Desert has been more or less closely examined, and other meteoritic masses have been found. Still, the number of meteorites yet discovered, distinct either in mineralogical characters or locality, is shown to be, at most, thirteen.

One of them, Lutschaunig, is distinct from all the rest as being a chondritic stone; a second, Vaca Muerta, likewise differs from all the others in that it consists of nickel-iron and stony matter, both in large proportion; a third, Imilac, is a nickel-iron with cavities, like those of a sponge, filled with olivine; a fourth, Copiapo, is a nickel-iron with irregularly disposed angular inclosures of troilite and stony matter; the remaining nine consist of nickel-iron, virtually free from silicates, some of them showing no Widmanstätten figures when etched, others showing excellent figures more or less differing in character.

Now, in every meteoritic shower yet observed, the individuals which have fallen simultaneously have been found to belong to a common type. Hence, it is reasonably certain that several distinct meteors are represented in the Desert, and that the above masses are the result of several falls; and this being accepted, the assertion of simultaneity of fall of two or more masses on the purely geographical ground that they have been found in the same Desert, can be allowed no great weight.

But have masses belonging to any one of the above types been found scattered over a part of the Desert so extensive as to indicate a meteoritic fall more widely spread than any of those actually observed? A critical examination of the cases in which such an enormous spread has been asserted proves that the evidence is quite unsatisfactory. The results may thus be summarized:—

(1) *Lutschaunig.*—This was a single stone.

(2) *Vaca Muerta.*—The masses were in great abundance distributed over a small area. But fragments undoubtedly belonging to this type have been brought from two other places far distant from the main locality. Very cogent evidence is brought forward to prove that the said fragments must have been *carried* to those places—the Jarquera Valley and Mejillones—from Vaca Muerta itself.

(3) *Imilac.*—An examination of all the known literature indicates that the whole of the fragments belonging to this type have been got from the immediate neighbourhood of Imilac. Caracoles, Potosi, and Campo de Pucará, from which specimens, belonging to this type, have been brought, are shown to be on regular lines of traffic starting from the Atacama coast. It is further shown that Imilac specimens were in great request, and were certainly carried to very distant places along such lines of traffic.

(4) *Copiapo.*—It is conclusively proved that the two localities, upwards of 400 miles apart, for meteoritic masses belonging to this type, result from a mere interchange of labels, and that all the masses probably came from a single place.

(5–13) There is no satisfactory evidence furnished by similarity of type for any of the meteoric irons being part of a widespread shower.

It is thus clear that the meteorites of the Desert of Atacama afford absolutely no proof that enormous meteoritic showers have ever reached the earth's surface.

The general dryness of the air of the Desert, and the rarity of rain, have been sufficient to ensure the preservation of masses which have fallen in the course of many centuries unto a time when an exploration of a large extent of the Desert has taken place.

That the meteoritic masses are far from being so plentiful as has been imagined is conclusively proved by the experience of Mr. George Hicks, one of the earliest explorers of the 23rd and 24th parallels; although much interested in their occurrence, he never found a mass himself, and he only obtained his first specimen after years of persevering inquiry from the Indians.

Detailed information relative to the Atacama meteorites, with a description and map of the Desert, will be found in the recently published number of the *Mineralogical Magazine.* L. F.

EARLY EGYPTIAN CIVILIZATION.

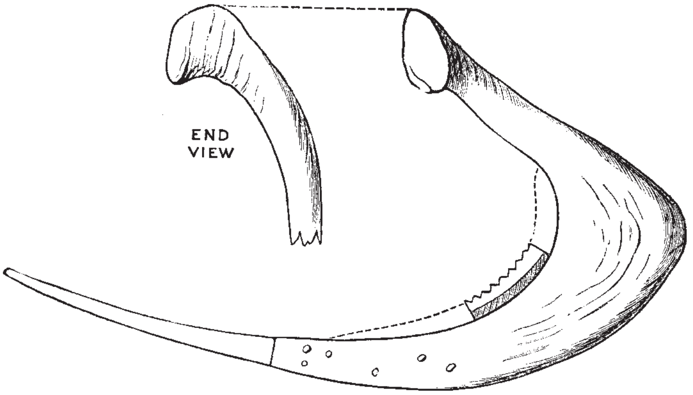
ALTHOUGH the paintings in the tombs of Memphis, of Beni Hasan, and of Thebes, have preserved to us the knowledge of much of the civilization of Egypt, yet hitherto we have handled but few examples of the implements used, and those are mostly undated. Broadly speaking, the three sites just named represent respectively the Old Kingdom before 3400 B.C., the Middle Kingdom about 2600 B.C., and the New Kingdom from 1600 B.C.; and though debarred from scientific work in these richest districts of Egypt—owing to national jealousies—I have been fortunate enough to discover two small towns, each only occupied for a couple of centuries, which have thus revealed the works of the Middle and New Kingdoms with chronological exactness. Beside the Egyptian interest of these places, they are of prime importance for Mediterranean history, having been colonies of foreign workmen.

These towns are one on each side of the entrance to the Fayum province, fifty miles south of Cairo. The northern town, now called Kahun, was built for the workmen employed by Usertesen II., for his pyramid and temple, about 2600 B.C. The southern town, now called Gurob, was founded by Tahutmes III., and destroyed by Merenptah, thus lasting from about 1450 to 1190 B.C. Obtaining thus two sites of different ages, close together, we can be certain that all differences are due entirely to time and not to locality. The change in an interval of 1200 years is most marked. Of the pottery, scarcely a single type of form or material is alike in the two periods; of the many varieties of beads of stone and glazed ware, hardly one was continued; the metal tools are every one changed in form; and the use of flints had practically died out. For the first time we are able to trace the definite and decided changes in all the products of two ages so remote. The idea that Egypt was changeless is only due to our lack of knowledge; not only fashions changed—every few years in minor details—but radical rearrangements were made from age to age in the manufactures.

The twelfth dynasty town—Kahun—is the more important, and we will briefly note some of its products. Flint working was carried to a high pitch, the thin flat knives being flaked with much skill: but alloys of copper were also in use, and show ability in their casting and hammering, a thin bowl being wrought out of one piece. We find, then, flint and metal side by side, the flint being the commoner material, but yet influenced in its forms by the types of metal tools. Moreover, we now see the use of the numerous flint saws, formed of serrated flakes; many of them have black cement upon them, and one was found remaining in its socket in a wooden sickle (Fig. 1).

Beside hatchets, adzes, and chisels of bronze, we find needles, barbed and unbarbed fish-hooks, netting-needles, and knives of the straight-backed type. Among wooden tools are hoes, rakes, grain-scoops, a brick-mould, plasterers' floats, bow-drills, plummets, &c. Perhaps the most important of all is a fire-stick, on which five burnt holes remain where fire has been drilled by a rotating rod: the drilling was begun by hacking a groove in the side of the stick, down which the heated wood powder might run, until it caught alight. This shows, for the first time, how the Egyptians obtained fire: and familiar as they were with the bow-drill, they doubtless used it for the fire-stick. A very interesting point is the origin of the shoe from the sandal. Two sandal-shoes have been found; both with toe and heel straps, but with an upper of leather across the foot. Tops, tip-cats, clay toys, dolls with jointed limbs, and game boards, were all in use. Among a large number of papyri that I found are two wills, one of which is a recital of a will and a settlement, duly witnessed. The provisions show that the later law of Greek times was much the same in matters of descent as it was two thousand years earlier. On receiving family property the man settles it on his wife; she has a life interest in the dwellings, and may divide all the property among their children at her discretion. The man's official position he left to his son. A guardian was also appointed, excluding the eldest son from that duty. Some numerical notes concerning fractions are also found; and all these papyri are in course of study by Mr. F. L. Griffith.

Fig. 1.



Wooden sickle with flint saw (twelfth dynasty).

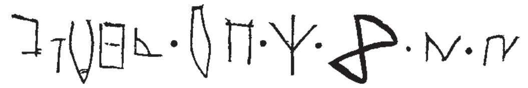
On turning to the later town—Gurob—of about 1300 B.C., we find that the art of flint working was lost; only a few rude leaf-shaped flakes (totally different from the earlier forms) and some little saw-flakes remain, and these are scarce. Thus we may date the fall of fine flint manufacture in Egypt to about 2000 B.C.; though rude flakes continued to be used till late Roman times, and more abundantly in poorer ages. Bronze tools were much modified; hatchets and chisels less finely formed, knives always double edged, fish-hooks not barbed, and punched metal rasps were brought in. Bronze working reached a high level in the making of two large pans, 14 and 9 inches across, exquisitely wrought with difficult curves, and so thin that they can be still bent in and out by the fingers. Glass ornaments were commonly used, though not found in the earlier town. The plain beads of fine blue, violet, &c., belong to about 1300 B.C.; while the coarser beads of black, yellow, green, brown, and white, with eye-patterns, are about a century later.

The presence of foreigners in both of these towns is shown by the weights discovered, which are—with scarcely an exception—of foreign standards, foreign forms, or foreign materials. A commercial intercourse must therefore have been kept up between these foreign colonies and the Mediterranean. Beside this evidence we find at Gurob the burials of one of the Tursha or Turseni (from Asia Minor), and a Hittite; foreign art is seen in a mirror handle with the Phœnician Venus, and a wooden figure of a Hittite; and foreign complexions are shown by the light hair found on some of the bodies. A very strong Mediterranean influence appears in the quantity of pottery identical with the earliest styles found at Mykenæ, at Thera, and at Mytilene; and we are now able to date those stages of early culture in the Greek lands to 1300 B.C., a fixed point of the greatest value.

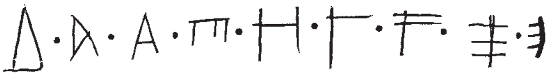
The most novel discovery of all is the presence of apparently alphabetic signs in use in both towns (Fig. 2), and by all the circumstances amply guaranteed to be of about 2500 B.C. and 1300 B.C. Our existing theories of alphabetic development require us to suppose that the Phœnician letters were established before 2000 B.C.; as the Egyptian writing from which De Rougé derived them, was extinct after that date; and the Cypriote syllabic signs must be older. Thus, though no known inscriptions can be placed before about 900 B.C., yet the forms must have started about the same period as that of the first of these towns, Kahun. The conditions that we find, therefore, of a great variety of signs in use, many of which have not survived, while others have drifted apart into many different alphabets, are just what might be expected at these early times. The apparent connection of these signs with some of the mason's marks of Egypt suggests that they may have been adopted by the foreign workmen from their Egyptian fellow-labourers; and the very lack of literary education among such men would lead to their forming alphabets of their own from such materials. We have at least now obtained two well-defined stages, between the finished and segregated alphabets of the period of known inscriptions, of 900 B.C. downward, and the original elements of Egyptian hieroglyphs, hieratic, mason's marks, and perhaps Hittite and cuneiform characters, from which the alphabets were evolved. To discuss the historical descent of the signs, and to form a continuous theory of them, will need much discussion, and more materials. Meanwhile, my work will lie in the complete gathering in of what may still remain in these towns. A full account and drawings of every sign and every object of importance found this year will appear in a few months.

W. M. FLINDERS PETRIE.

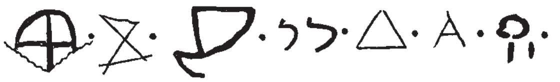
FIG. 2.



Continuous inscription on wood. Signs incised in pottery (the dots separating different examples.



Signs incised on pottery of the twelfth dynasty (Kahun).



Signs on pottery of the eighteenth to nineteenth dynasty (Gurob).

MR. STANLEY'S GEOGRAPHICAL DISCOVERIES.

THIS week an interesting letter from Mr. Stanley to Colonel Grant has been published. It is dated, "Villages of Batundu, Ituri River, Central Africa, September 8, 1888." Speaking of Lake Albert, Mr. Stanley says:—

"When on December 13, 1887, we sighted the lake, the southern part lay at our feet almost, like an immense map. We glanced rapidly over the grosser details—the lofty plateau walls of Unyoro to the east, and that of Baregga to the west, rising nearly 3000 feet above the silver water, and between the walls stretched a plain—seemingly very flat—grassy, with here and there a dark clump of brushwood—which as the plain trended south-westerly became a thin forest. The south-west edge of the lake seemed to be not more than six miles away from where we stood—by observation the second journey I fixed it at nine miles direct south-easterly from the place. This will make the terminus of the south-west corner at 1° 17′ N. lat. By prismatic compass the magnetic bearing of the south-east corner just south of Numba Falls was 137°, this will make it about 1° 11′ 30″ N. lat. A magnetic bearing of 148° taken from N. lat. 1° 25′ 30″ about exactly describes the line of shore running from the south-west corner of the lake to the south-east corner of the Albert. Baker fixed his position at N. lat. 1° 15′, if I recollect rightly. The centre of Mbakovia Terrace bears 121° 30′ magnetic from my first point of observation, this will make his Vacovia about 1° 15′ 45″, allowing 10° west variation.

"In trying to solve the problem of the infinity of Lake Albert as sketched by Baker, and finding that the lake terminus is only four miles south of where he stood to view it 'from a little hill,' and on 'a beautifully clear day,' one would almost feel justified in saying that he had never seen the lake. But his position of Vacovia proves that he actually was there, and the general correctness of his outline of the east coast from Vacovia to Magungo also proves that he navigated the lake. When we turn our faces north-east, we say that Baker has done exceedingly well, but, when we turn them southward, our senses in vain try to penetrate the mystery, because our eyes see not what Baker saw. When Gessi Pasha first sketched the lake after Baker, and reduced the immense lake to one about ninety miles long, my faith was in Baker, because Gessi could not resolve by astronomical observations the south end of the lake. When Mason Bey—an accomplished surveyor—in 1877 circumnavigated the lake, and corroborated Gessi, then I thought that perhaps Mason had met a grassy barrier or sandbank overgrown with sedge and ambatch, and had not reached the true beyond, because he admitted that he could not see very far from the deck of his steamer, my faith still rested in Baker; but now, with Lieutenant Stairs, of the Royal Engineers, Mr. Mounteney Jephson, Surgeon Parke, Emin Pasha, Captain Casati, I have looked with my own eyes upon the scene, and find that Baker has made an error. . . .

"I am somewhat surprised also at Baker's altitudes of Lake Albert, and the 'Blue Mountains,' and at the breadth attributed by him to the lake. The shore opposite Vacovia is ten and a quarter miles distant, not forty or fifty miles; the 'Blue Mountains' are nothing else but the west upland—the highest cone or hill being not above 6000 feet above the level of the sea, not 7000 or 8000 feet high. The altitude of Lake Albert by aneroid and boiling-point will not exceed 2350, not 2720, feet.

"And last of all, away to the south-west where he has sketched his 'infinite' stretch of lake, there rises, about forty miles from Vacovia, an immense snowy mountain—a solid square-browed mass with an almost level summit between two lofty ridges. If it were 'a beautifully clear day' he should have seen this, being nearer to it by thirteen geographical miles than I was."

Of the snowy Mountain, Mr. Stanley writes as follows:—

"My interest is greatly excited, as you may imagine, by the discovery of Ruwenzori—the Snowy Mountain—a possible rival of Kilimanjaro. Remember that we are in north latitude, and that this mountain must be near on the equator itself, that it is summer now, that we saw it in the latter part of May, and that the snow-line was about (estimate only) 1000 feet below the summit. Hence I conclude that it is not Mount Gordon Bennett, seen in December 1876 (though it may be so), which, the natives said, had only snow occasionally. At the time I saw the latter, there was no snow visible. It is a little further east, according to the position I gave it, than Ruwenzori.

"All the questions which this mountain naturally gives